Original article

Extracranial hemorrhage in babies admitted to neonatal units over a 10-year period

Yifru Berhan[1], Assaye Kassie[2]

Abstract

Background: Extracranial hemorrhage is one of the complications of instrumental delivery associated with increased risk of mortality. Absence of published data in Ethiopia on this issue was the motivation for this study.

Objective: The objective of this study is to review extracranial hemorrhage cases (cephalhematoma and subgaleal hemorrhage) and outcomes of treatment.

Methods: A retrospective record review of extracranial hemorrhage case series admitted to the neonatal unit between January 1993 and December 2002 was undertaken. Antepartum and intrapartum history, neonatal problems developed due to extracranial hemorrhage, progress evaluated by clinical, laboratory and anthropometric indicators and the final outcomes were analyzed.

Results: A total of 701 cases of extracranial hemorrhage were registered during the study period. Of which, 76.6% were subgaleal hemorrhage and 24.4% were cephalhematoma with 74 and 15 deaths, respectively. Instrumental delivery or attempts alone accounted for 71.5 % of subgaleal hemorrhage cases. In contrast, more cases of cephalhematoma were found in spontaneous vertex delivery, breech delivery, health center and home deliveries. The severity of blood loss in subgaleal hemorrhage was marked by causing 81.9% cases of of severe anemia, of which 106 being found in hemorrhagic shock and 87.9% above 90th percentile head circumferences.

Conclusion: Although instrumental delivery or attempt was dominant on the occurrence of subgaleal hemorrhage, there was no mode of delivery safe for extracranial hemorrhage. Cephalhematoma was not always benign as reported in literature. Hemorrhagic shock was the commonest cause of death in both subgaleal hemorrhage and cephalhematoma. The choice and application of instrumental delivery are areas of further investigation. [*Ethiop.J.Health Dev.* 2004;18(3):190-198]

Introduction

Extracranial hemorrhage (ECH) is one of the common complications of instrumental deliveries (1). However, it can occur in all modes of delivery, even *in utero* prior to the onset of labor (2-6). Commonly incriminated natural and iatrogenic risk factors for the occurrence of extra cranial hemorrhages are the shearing effect of instrumental delivery, difficult extraction, prolonged cup application, use of metal cups, use of forceps after failed vacuum, primigravidity and primary or secondary coagulopathy (3-12). Other risk factors identified in previous studies include intrapartal hypoxia, prematurity, male sex, macrosomia, prolonged labor, cephalopelvic disproportion and African lineage (2).

Based on scalp anatomy and clinical presentation, hemorrhages deep in the scalp and outside the calvarium are categorized into cephalhematoma, subgaleal hemorrhage, caput succedaneum and vacuum caput under the umbrella of ECH (1,13). The latter two, by virtue of their benign nature, are clinically less important and do not necessitate hospitalization, and thus weren't included in this study.

Subgaleal hemorrhage (SGH), perhaps the most serious complication of instrumental delivery, is extravasations of blood in a wide space between the galea aponeurotica and the periosteum of cranial bones. This potentially large and unlimited space extends from the temple to the nape of the neck antero-posteriorly, and to the level of ears laterally, which allows spreading of hematoma across the entire calvarium (13). In term babies, this subaponeurotic space may hold as much as 260 ml of blood (which is almost equivalent to the baby's blood volume).

Subgaleal hemorrhage can therefore lead to severe hypovolemia, and in one study showed that up to one quarter of babies who require neonatal intensive care for this condition die (17). It may be on account of this anatomic incompetence and delay in detection and therapeutic intervention, the mortality of SGH ranges from 2.7% to 22.8% (2-4,7). However, in one series of 101 cases, there was no single death reported (15).

Like cephalhematoma, SGH has been found after all modes of delivery (2-5). A literature review done about 22 years back to 123 cases of SGH showed that cases of SGH resulted from vacuum extraction 60 (48,8%), spontaneous vaginal delivery 35 (28.8%), forceps 14 (13.8%) and caesarean section delivery 11 (8.9%)(2). However, more recent studies showed the exclusive association of SGH with vacuum extraction (3,4,7).

[1]Department of Gynecology and Obstetrics, Faculty of Medicine, Addis Ababa University, P.O. Box 23558, E-mail yifrub@yahoo.com, Addis Ababa, Ethiopia; [2]Department of Pediatrics, Faculty of Medicine, Addis Ababa University

Reports from a tertiary pediatric referral hospital in Western Australia, showed that over 24 year period, there were 37 neonates with SGH admitted (7). In about a 5 year period, only 4 cases of SGH (17) were reported in one children's hospital in Canada.

The purpose of this study is to assess ECH related mortality and morbidity in a period of 10 years in the unit, to describe the occurrence of ECH in various modes of delivery among neonates presented to the unit and admitted with this problem, and to evaluate intervention outcomes.

Methods

A retrospective record review of all SGH and CH cases admitted to the neonatology unit at Tikur Anbessa teaching hospital was undertaken for the period of January 1993 to December 2002. Tikur Anbessa Hospital is the only referral hospital in the capital, with an established neonatology unit. This unit has been offering curative services for neonates referred from different health institutions or self-referred from home.

Variables included in the data-collecting format were maternal socio-demographic characteristics, parity, antenatal care, gestational age, obstetric diseases, drug intake or substance use, vitamin k prophylaxis, mode of delivery, place of delivery, Apgar scores at 5 minutes, obstructed labor or cephalo-pelvic disproportion, common neonatal problems related to ECH, admission and final (discharge/death) laboratory results and anthropometric measurements, treatment given, hospital stay, as well as death and possible cause of death.

Medical records of the neonatal unit (admission record book, patient cards, residents' admission and discharge report) and record books from the statistics unit of Tikur Anbessa Hospital were used as sources of data. These databases made the medical information of each study subject complete for this review regarding maternal social history, obstetric history, clinical presentation, laboratory data and management intervention carried out and final outcomes.

In this study, ECH refers to CH or SGH diagnosed in the neonatology unit. The clinical or sonographic diagnosis of CH was made when the accumulation of blood occurred beneath the periosteum of thecranial bone and limited by sutural attachments. On the other hand, the diagnosis of SGH was made when the accumulation of blood crosses the suture lines and distributed in the large potential space between the galea aponeurotica of the scalp and the periosteum of cranial bones.

Birth weight was categorized with 500grams interval to examine the effect of relatively moderate birth weight discrepancy on ECH. On arrival to the neonatology unit the age of the neonate was also categorized with 24-hours interval to identify the time interval between birth and bleeding noticed and the extent of bleeding.

Based on the lowest hematocrit (HCT) or hemoglobin (HB) level recorded either on arrival or then after each case was grouped into severe anemia (HCT$\leq$ 20% or HB<7gm), moderate anemia (HCT 21%-30% or HB 7-10gm), mild anemia (HCT 31%-45% or HB 10.5-15gm) and no anemia (HCT >45% or HB >15gm) (20,21).

The head circumferences (HC) measured in centimeter and standardized with Luchenco curve were labeled as < 10^{th}, 10^{th}-50^{th}, 50^{th}-90^{th} and >90^{th} percentile (18). Pathologic (nonphysiologic) hyperbilirubinemia was regarded when the indirect serum bilirubin was >12mg/dl for full term or 10-14mg/dl for preterm neonates or when the direct bilirubin level was >2mg/dl or if the increment was 5mg/dl/24 hours or if it appeared in the first 24 hours of age or it is was persistent and required treatment (19).

All Data were entered and analyzed using Epi Info version 6.0 computer program. Graphs were developed using Microsoft excel and SPSS 10.0 for windows. P-values <0.05 were considered statistically significant.

Result

In a period to 10 years (1993-2002), of the 701 neonates who were admitted to the Tikur Anbessa hospital neonatal intensive care unit (ICU) with extracranial hemorrhages (ECHs), 76.6% (n=530) subgaleal hemorrhage (SGH) and 24.4% (n=171) cephalhematoma (CH), were reviewed. Figure 1 shows the cases and deaths of extracranial hemorrhage. In general, the number of SGH cases admitted to the unit was increasing over the study period.

The highest mortality secondary to ECH was also recorded in 2002 with SGH predominance. The total admission in ICU increased from 1993 to 2002 by about 15% (1421 and 1643, respectively) while the total cases of ECH increased by 75% (56 to 98) after 10 years. Six hundred ninety one (98.6%) were delivered in the capital, either in a health institution 668 (95.3%) or at home 33 (4.7%), and referred soon or later on.

As it is shown in Table 1, the occurrence of ECH among neonates admitted with this problem was highest in those born to primigravida mothers; 68.3% (n=362) of SGH

and 68.4% (n=117) of CH were babies of primigravida mothers.

Since a majority of the neonates that came from the capital where home delivery and prolonged labor are less likely, total duration of labor in hours was < 12,12-24 and >24 in 45.4%, 41.8% and 12.8%, respectively.

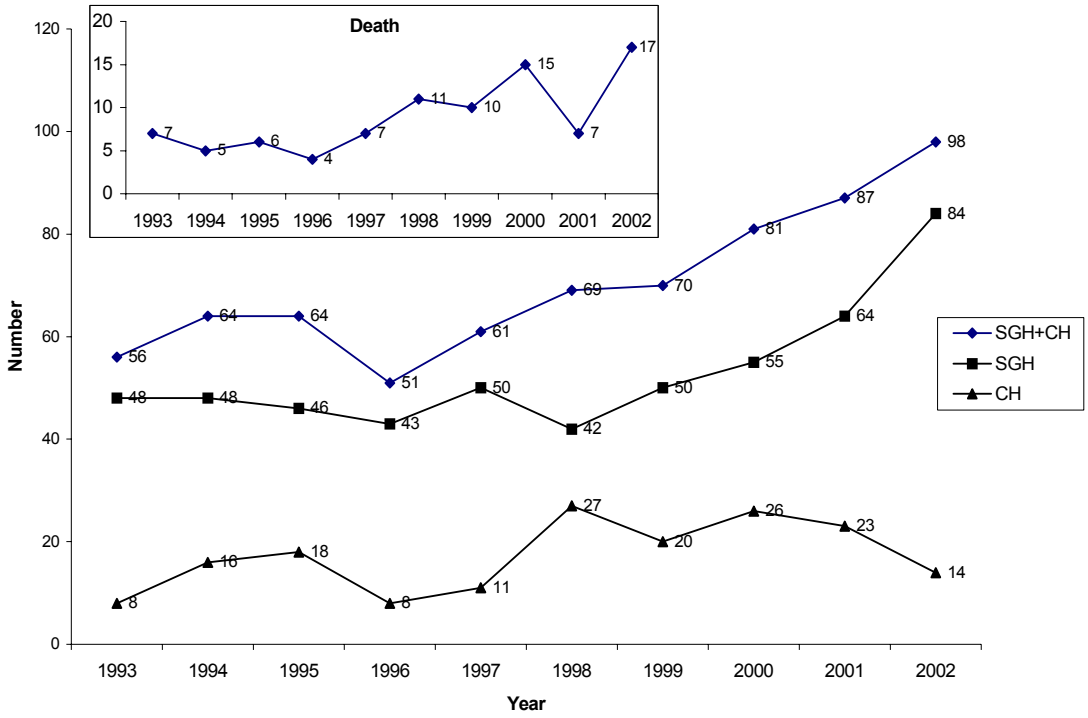

Figure 1: **Trend of subgaleal hemorrhage (SGH) and cephalhematoma (CH) in neonates.**

In general, ECH of the SGH and CH variety was found to be highly common in male neonates among those admitted to the unit as a case of ECH; with a male to female ratio of about 3:1. Five hundred twenty one (74.3%) and 180(25.7%) were male and female neonates, respectively. This was also shown on specific SGH and CH cases. Three hundred ninety eight (75.1%) SGH and 123 (71.9) CH cases were male babies. All 5 for whom elective caesarean sections were done and found to have ECH were male babies. Furthermore, out of the total deaths, 70 (78.6%) were male babies. However, the rate of mortality out of the total cases in the two sexes was almost proportional, 70(13.4%) male vs 19(10.6%) female babies.

Birth weight ranged 2410-4400 grams (gm) and gestational age varied 36-43 weeks (with median 39 for SGH cases and 40 for CH cases). In both SGH and CH cases, the majorities of the birth weight lie in the range of 3000-3499 gm with the second highest 2500-2499 gm. About 39% of (n=209) SGH and 35.0% (n=60) of CH cases were under 3000-3499 gm categories, respectively. Out of the total neonates diagnosed and admitted as a case of ECH, 11.7% of SGH and 7.8% of CH were referred with Apgar scores of less than 7 at the 5th-minute of birth.

Two-thirds of SGH and two-fifths of CH were referred and arrived at the ICU before 24-hours of age after birth; however, among the latecomers, CH cases were higher than SGH cases, 21.6% vs 4.0%, respectively. There were a few CH cases that came very late, 7-11 days after birth, and deserved admission and therapeutic intervention for pathologic hyperbilirubinemia.

The five commonest modes of delivery (Table 2) associated with ECH among neonates deserved admission with this problem were, with decreasing order: vacuum extraction 237 (33.8%), spontaneous vertex delivery 160 (22.8%), forceps delivery 117 (16.7%), emergency caesarean section (vacuum or forceps untouched) 75 (10.7) and failed vacuum effected by caesarean section (C/S) 44 (6.3%). Successful and failed instrumental deliveries, however, were associated with about two-thirds of the total neonates with ECH (63.9%). Nevertheless, it was found that there was almost no ECH risk-free mode of delivery; breech delivery and elective

C/S accounted for 13 (1.9%) and 5 (0.7%) of the total cases, respectively.

Table 3 shows the level of blood loss in the two categories of ECH, SGH vs CH, as well as in relation to various modes of delivery. The hematocrit level of 59.8% (n=419) neonates was in the range of neonatal anemia. Of these, 144 (34.4%), 93 (22.2%) and 182 (43.4%) of the total developed severe, moderate and mild anemia, respectively. The severity of blood loss in SGH cases expressed in terms of hematocrit (HCT) level as severe (< 20%), moderate (21%-30%) and mild (31%-45%) were more than fourfold, twofold and threefold of CH cases, respectively. Among neonates whose lowest HCT level < 20% (n=144), 50.8% of SGH and 34.6% of CH were found to have 8%-15% HCT level and in hemorrhagic shock. It is also shown that the head circumference (HC) and HCT level were inversely related; neonates with lowest HCT level of < 20%, 94.4% had more than 90th percentile HC.

Table 1: **Maternal and neonatal demographic details of neonates with extracranial hemorrhage, Tikur Anbessa Hospital, 1993-2002.**

Characteristics	Subgaleal hemorrhage (SGH) (N = 530)	Cephalhematoma (CH) (N = 171)
Maternal age (yr) mean ± SD	24± 5.3	26±4.6
Married n (%)	452(85.3)	140(81.9)
Primiparity n (%)	362(68.3)	117(68.4)
Median gestational age (week) (range)	39(37-42)	40(36-43)
Antenatal care n(%)	451(85.1)	149(87.1)
Duration of labor(hr) ≥24 n(%)	69(13.0)	21(12.3)
Fetal birth weight (g) n(%)		
<2500¢	42(7.9)	21(12.3)
2500-2999	135(25.4)	54(31.6)
3000-3499	209(39.5)	60(35.1)
3500-3999	112(21.1)	25(14.6)
≥4000¢	32(6.1)	11(6.4)
Male baby n (%)	398(75.1)	123(71.9)
Neonatal age on arrival to ICU (hr) n(%)		
<24	370(69.8)	70(40.9)
24-48	81(15.3)	16(9.4)
49-72	38(7.2)	21(12.3)
72-96	20(3.8)	27(15.8)
>96	21(4.0)	37(21.6)

¢ The lowest and highest birth weight were 2410 and 4400 grams, respectively.
SD- standard deviation, ICU- Intensive care unit

Table 2: **Occurrence of extracranial hemorrhage in different modes of delivery, Tikur Anbessa Hospital, 1993-2002.**

Mode/place of delivery	SGH (N =530)(%)	CH (N =171)(%)	Total (N =701)(%)
Mode of delivery			
Vacuum	193(36.4)	44(25.7)	237(33.8)
Spontaneous	80(15.1)	80(46.8)	160(22.8)
Forceps	96(18.1)	21(12.3)	117(16.7)
Emergency C/S	65(12.3)	10(5.8)	75(10.7)
Failed vacuum effected by C/S	42(7.9)	2(1.2)	44(6.3)
Failed vacuum effected by forceps	36(6.8)	0	36(5.1)
Breech	3(0.6)	10(5.8)	13(1.9)
Failed vacuum, failed forceps effected by C/S	7(1.3)	2(1.2)	9(1.3)
Failed forceps effected by C/S	5(0.9)	0	5(0.7)
Elective C/S	3(0.6)	2(1.2)	5(0.7)

Total instrument intervene	379(71.5)	69(40.4)	448 (63.9)
Place of delivery			
Government hospital	406(76.6)	98(57.3)	504(71.9)
Government H/C	48 (9.1)	35(20.5)	83(11.8)
Private clinic or hospital	61(11.5)	20(11.7)	81(11.6)
Home	15(2.8)	18(10.5)	33(4.7)

SGH-Subgaleal hemorrhage, CH-Cephalhematoma, C/S-Caesarean section, H/C- Health center

Table 3: **Mode of delivery versus severity of blood loss in extracranial hemorrhage, Tikur Anbessa Hospital, 1993-2002.**

	Lowest Hematocrit Level (%)			
Characteristics	**≤ 20 (n=144)(%)**	**21-30 (n =93)(%)**	**31-45 (n =182)(%)**	**> 45 (n =282)(%)**
Extracranial hemorrhage type				
Subgaleal hemorrhage	118(81.9)	64(68.8)	140(76.9)	208(73.8)
Cephalhematoma	26(18.1)	29(31.2)	42(23.1)	74(26.2)
Mode of delivery				
Vacuum	48(33.3)	30(32.3)	59(32.4)	100(35.5)
Spontaneous	52(36.1)	26(28.0)	33(18.1)	49(17.4)
Forceps	9(6.2)	10(10.8)	39(21.4)	59(20.9)
Emergency C/S†	20(13.9)	12(12.9)	20(11.0)	23(8.2)
Failed vacuum effected by C/S	2(1.4)	6(6.5)	13(7.2)	23(8.2)
Failed vacuum effected by forceps	3(2.1)	6(6.5)	13(7.2)	14(4.9)
Breech	4(2.8)	3(3.2)	2(1.1)	4(1.4)
Failed vacuum, failed forceps effected by C/S	2(1.4)	0	1(0.5)	6(2.1)
Failed forceps effected by C/S	1(0.7)	0	2(1.1)	2(0.7)
Elective C/S*	3(2.1)	0	0	2(0.7)
Total instrument intervene	65(45.1)	52(55.9)	127(69.8)	204(72.3)
Maximum head circumference				
<10th percentile	0	0	0	0
10th – 50th percentile	0	1(1.1)	1(0.5)	2(0.7)
50th – 90th percentile	8(5.6)	11(11.8)	25(13.8)	88(31.2)
>90th percentile	136(94.4)	81(87.1)	156(85.7)	192(68.1)

† Caesarean section (C/S) done for other indications (unrelated to instrumental delivery failure)

∗ All done for transverse lie.

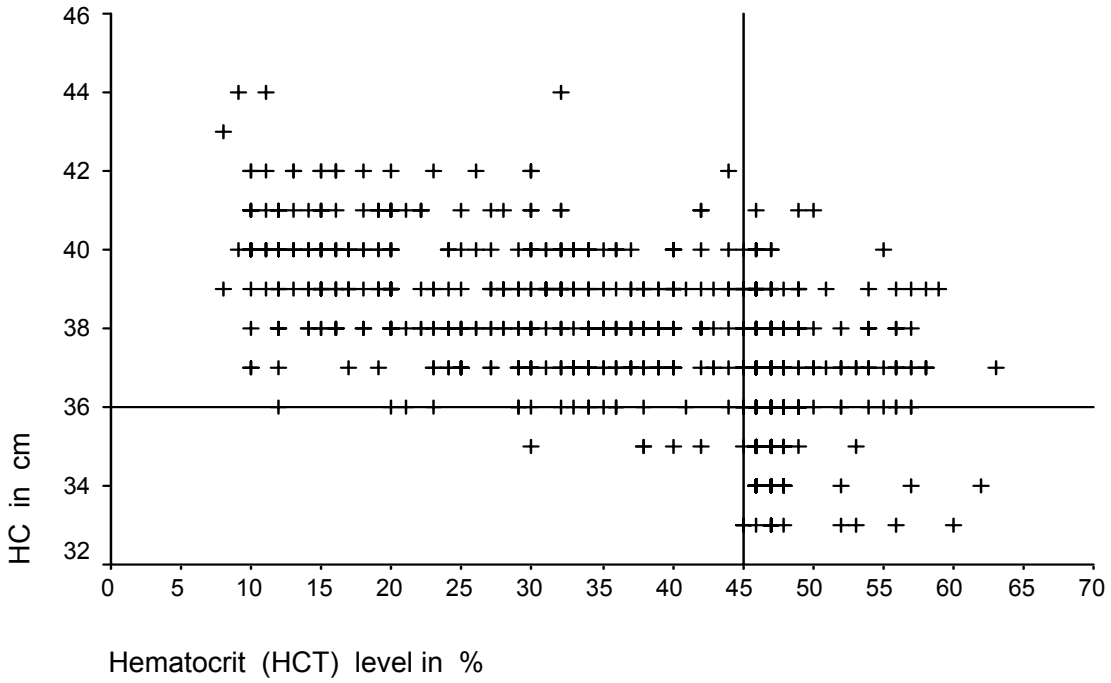

Figure 2: **Head circumference (HC) versus hematocrit level in neonates with extracranial hemorrhage. r = - 0.59, P<0.0001**

Figure 2 is to show the relation of the HC and HCT levels in neonates with ECH. As the hematoma increases, the HC also increases while the HCT level drops i.e. the inverse relation of HCT level and HC (Pearson correlation coefficient (r) = -0.59 and P < 0.0001) describes the proportion of extracranial blood loss. In particular for neonates with the lowest HCT levels below 30%, all the HCs were beyond the 90th percentile.

In Table 4, the common complications and manifestations of ECH, therapeutic measures undertaken and length of hospitalization and deaths in both cases are presented. Overall, the HC of 80.6% (n=565) of the total cases were beyond the 90th percentile. To be specific, the severity of blood loss in SGH cases was revealed on high record of HC above 90th percentile, 466 (87.9%), and it was found to be statistically significant (p<0.0001). The limitation of blood loss in CH did not have much effect on the HC as SGH did. Furthermore, the occurrence of hemorrhagic shock in babies with SGH was also statistically highly significant as compared with CH cases (p<0.0001). Since some of the neonates discharged before complete resolution of the hematoma, but with declining HC and raising HCT level, 20.6% were discharged with HC> 90th percentile.

There were 104 (14.8%) neonates diagnosed to have pathologic hyperbilirubinemia secondary to massive blood loss and hemolyses. Overall, whole blood or packed red blood cells transfusion and double volume exchange transfusion for 199(28.4%) and 93(13.3%) neonates with ECH were administered, respectively. However, the differences between SGH and CH were not statistically significant.

As it is also shown in Table 4, 89 (12.7%) neonates died due to complications of ECH with a case-fatality ratio (CFR) of 0.12 and 0.09 for SGH and CH, respectively. Among ECH complications, the leading cause of mortality was hemorrhagic shock, which accounted for 67.4% (n=60) of the total deaths. In other words, the proportion of mortality among neonates in shock was half of the total cases. Other possible causes of ECH related mortality incriminated were congestive heart failure secondary to severe anemia with or without multiple organ failure and bilirubin encephalopathy (kernicturus). There were also deaths due to multiple factors, ECH related and unrelated accounting for 11(12.4%) of the total mortality. The role of early detection and intervention is also seen by 100% mortality in those neonates who stayed in the hospital for less than 24 hours after delivery and progressive declining of mortality proportion as the neonates stayed in the hospital a little longer. Of those who died early in the neonatal unit, almost all were neonates presented in hemorrhagic shock and failed to be transfused due to multiple factors implicated, or those who were having

progressive drop of HCT despite blood transfusions administered twice or more.

Table 4: **Complications, therapeutic interventions and out come in neonates with extracranial hemorrhage, Tikur Anbessa Hospital, 1993-2002.**

Characteristics	Total cases (n=701)		P-value	Total deaths (n=89)		Total Mortality proportion
	SGH(n=530)(%)	CH(n=171)(%)		SGH(n=74)(%)	CH(n=15)(%)	
Highest HC > 90th percentile‡	466(87.9)	99(57.9)	<0.0001	69(93.2)	9(60.0)	0.14
HC > 90th percentile (on discharge)#	108(20.4)	18(10.5)	0.005	------	-------	------
HCT ≤ 45% (lowest Value) ‡	322(60.7)	97(56.7)	NS	61(82.4)	8(53.3)	0.21
HCT > 45% (on discharge)#	423 (92.8)	140(89.7)	NS	------	--------	------
Apgar score at 5-min <7 (%)	62(11.7)	13(7.6)	NS	6(8.1)	2(13.3)	0.11
Hemorrhagic shock	110(20.7)	9(5.3)	<0.0001	55(74.3)	5(33.3)	0.50
Anemia without shock	212(40.0)	92(53.8)	<0.005	9(12.2)	3(20.0)	0.39
Pathologic hyperbilirubinemia	72(13.6)	32(18.7)	NS	7(9.5)	4(26.7)	0.11
Whole blood/packed RBC transfusion	152(28.7)	47(27.5)	NS	20(27.0)	3(20.0)	0.12
Double volume exchange transfusion	63(11.9)	30(17.5)	NS	7(9.5)	3(20.0)	0.11
Photo therapy	66(12.5)	44(25.7)	<0.0001	2(2.7)	1(6.7)	0.27
Hospital stay (day)						
< 1	33(6.2)	4(2.3)	NS	33(44.6)	4(26.7)	1.0
1 – 5	283(53.4)	86(50.3)	NS	32(43.2)	7(46.6)	0.11
6 – 10	162(30.6)	58(33.9)	NS	7(9.5)	1(6.7)	0.36
> 10	52(9.8)	23(13.5)	NS	2(2.7)	3(20.0)	0.67

‡ Highest head circumference and lowest hematocrit measured including survivors & deaths.
# Percentage calculated from the survivors.
SGH - Subgaleal hemorrhage, CH-Cephalhematoma, HC - Head circumference, HCT - hematocrit, RbC - red blood cell, NS - not significant

In 37 neonates, peripheral red blood cell examinations were undertaken and revealed normochromic-normocytic appearance, which can be an indirect evidence of acute blood loss. Erb's palsy (12 cases), facial palsy (10 cases), abscess formation in neonates with CH (9 cases) and subconjuctival hemorrhage (5 cases) were some of the other associated clinical problems identified. Every neonate on arrival to the ICU was given a therapeutic dose of vitamin k (2.5mg, intramuscular); however, no documentation was found in each referral sheet describing vitamin k administration at scene of birth. Seventeen (2.6%) and 71 (10.7%) mothers were diagnosed to have obstructed labor and cephalopelvic disproportion, respectively.

Discussion

Most literature (2,7,17) describe extracranial hemorrhage (ECH) as one of the rare complications primarily as a result of iatrogenic birth trauma. This study, however, revealed the common occurrence of ECH related mortality and morbidity in our set up, with dissimilar degrees in all modes of delivery. To cite some, even though it is difficult to give proportional inferences, due to lack of the denominator (total deliveries in the catchments area-including home and health institutions delivery), the occurrence of 530 SGH and 171 CH, who deserved hospitalization and therapeutic intervention in 10 years period, is not rare.

As it is shown in Figure 1, the progressively increasing trend of SGH cases and deaths may be a reflection of progressively increasing population base. Neonatal unit in the capital, conpled with the competence of the health workers at the referring health institution in the early detection of the problem might contribute to the increasing number of ECH cases admitted to the unit. However, the commonly contemplated benign course of CH (1, 14, 16) being found in some cases as serious as SGH is an important finding to look for some more risk-factors in our setup.

Other additional factors accounting for this high the number of admission to the neonatal unit for ECH, include: the injudicious use of instrumental deliveries, the high prevalence of cephalopelvic disproportion (22), now and then vitamin K prophylaxis administration for the newborns and almost everywhere less than 4 hours postpartum observation of neonates with good Apgar scores. To strengthen the latter, 5 minutes after birth, almost 90% of the total cases, the Apgar score considered to be one of the indicators of the perinatal status was 7 and above. It does convey the relatively late development of this serious bleeding condition in the early neonatal period in those who were potentially vulnerable to iatrogenic or obstetric predisposing risk factors.

Among the total cases of ECHs admitted, the predominance of SGH cases and deaths shows that once it occurred, the blood loss was progressive and significant to bring about serious mortality and morbidity. To be specific, the finding of about five-fold mortality, 12.2 fold hemorrhagic shock and more than 4.5 fold severe anemia in SGH than in CH cases is a consolidating evidence already reported (13,15,17). However, unlike other studies, who claim leave CH well alone! No treatment indicated (1,14,16), the mortality and morbidity for neonates with CH was also quite remarkable; there were 9 cases of hemorrhagic shock, 26 cases of severe anemia, 29 cases of moderate anemia, 32 cases of pathologic hyperbilirubinemia for whom whole blood or packed red blood cells transfusion and double volume exchange transfusion was done for 47 and 30 cases, respectively. Furthermore, the finding of 15 deaths and 9 abscess formation do speak the always non-benign course of CH in our situation and herald the necessity of close follow up till the HCT level build up and hematoma shows regression in size.

A recently conducted review of 5 large SGH case series studies showed a very significant male predominance with the male to female ratio ranging from 1.7:1.0 to 27.0:1.0, but they said that the reason for this difference is not known (24). In our finding, the male to female ratio of SGH cases was 3.01:1.0, which is higher than the lowest ratio reported but much lower than the highest.

On average, male newborns are 200 grams heavier than female newborns (23). Moreover, normal range (10^{th} -90^{th} percentile) of head circumference (HC) of male and female newborns is 33-36.6 cm and 32.9-35.5 cm, respectively (25). However, these minor anthropometric measurement differences between the two sexes don't sound much to justify for the extremely high male sex predilection of ECH recognized. In my opinion, prospective comparative studies with adjustment for other risk factors and workup on the bleeding tendency at birth in male sex constitute the area of investigation.

This study also demonstrated the development of ECH in all modes of delivery, including breech vaginal delivery and elective caesarean section, with due domination of vacuum extraction and spontaneous vertex delivery. Unlike other recent studies (3,4,7), which found very high association of SGH with vacuum delivery, this study with its limitation shows SGH occurrence with vacuum delivery not more than 10% of spontaneous vertex delivery. On the other hand, CH cases, to whom vacuum was applied with success, were more than 20% less than spontaneous deliveries.

In modern obstetrics, instrument choice, skill of the attending physician, time and duration of application is given much weight to avoid iatrogenic maternal and fetal trauma. Furthermore, once a selected instrument failed to progress with three pulls, resorting to caesarean section is highly recommended (26). In this review, for 45 (6.4%) of ECH cases, two instruments were applied. Such adventurous practice should no more be practiced in a situation where an immediate caesarean section setup is established.

All in all, more than two-thirds of ECH cases were secondary to instrumental intervention to effect delivery. This is still another evidence to question the emergency obstetric care that we are providing at different levels of health institutions. Instrumental delivery or attempt; however, doesn't seem to have an impact on the severity of blood loss, where about 55% of severe anemia and about half of moderate anemia were found in neonates born to vacuum or forceps untouched. Even in those ECH cases related with instrumental delivery, our type and choice of instrument, technique and frequency of application, and follow-up in the postnatal period has to be evaluated. It is recommended that monitoring include a minimum of 8 hours' observation for all neonates delivered by vacuum or forceps regardless of Apgar score or need for resuscitation (17).

It doesn't seem that instrumental delivery or attempt alone carries much weight for the incident of ECH; the 36.1% of the ECH cases in this study being unpreventable from occurrence (instrument untouched); the high number of male sex cases is a green light to investigate risk factors. However, even then, this study gives a decisive message to look into our peripartal care/intervention, and to give special emphasis to this fatal but partly preventable and treatable clinical emergency scenario.

Although TAH is the sole central referral hospital with a neonatal unit, only 10(1.4%) cases were from outside Addis Ababa. In my opinion, either there was delay/failure in detection of the problem by parents or health workers outside the capital and many of them died before arrival due to the rapidly killing nature of the disease (SGH) or because the hospital is too far to be accessible for the rural population or less attention given to sick newborns.

In conclusion, the over all admitted case series of ECH of SGH and CH variety was found to be marked with the former predominance in terms of both mortality and morbidity in 10 years period. To be noted, neonates who developed CH were not found to have a benign course although the severity of blood loss was not as such comparably as high as SGH cases. Both SGH and CH were found to be highest in primiparas, the male sex and instrumental delivery or attempt that is initiating to carry out risk factor investigation. High mortality was observed in those who developed hemorrhagic shock, pathologic hyperbilirubinemia, HC above 90^{th} percentile and those who stayed in the hospital for a short period of time. Therefore, taking poor emergency obstetric care as one possible risk factor, ECH is something that should always

click in our mind before each instrumental application or change of instrument to effects the delivery. More important being vigilant is necessary in the immediate post partum period and before discharging a neonate irrespective of the mode of delivery, of course with more emphasis to instrument intervene, proper evaluation and further follow up in a condition where the possibility of developing ECH is inevitable may do outweigh the antepartal-intrapartal care.

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